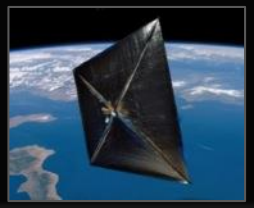
National Aeronautics and Space Administration

Moving Toward Model Based Systems Engineering

September 15, 2015

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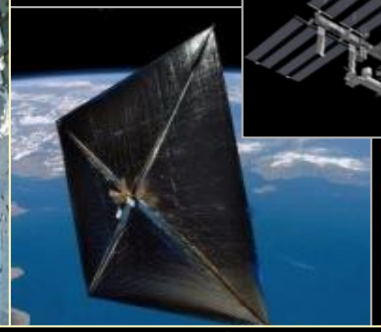
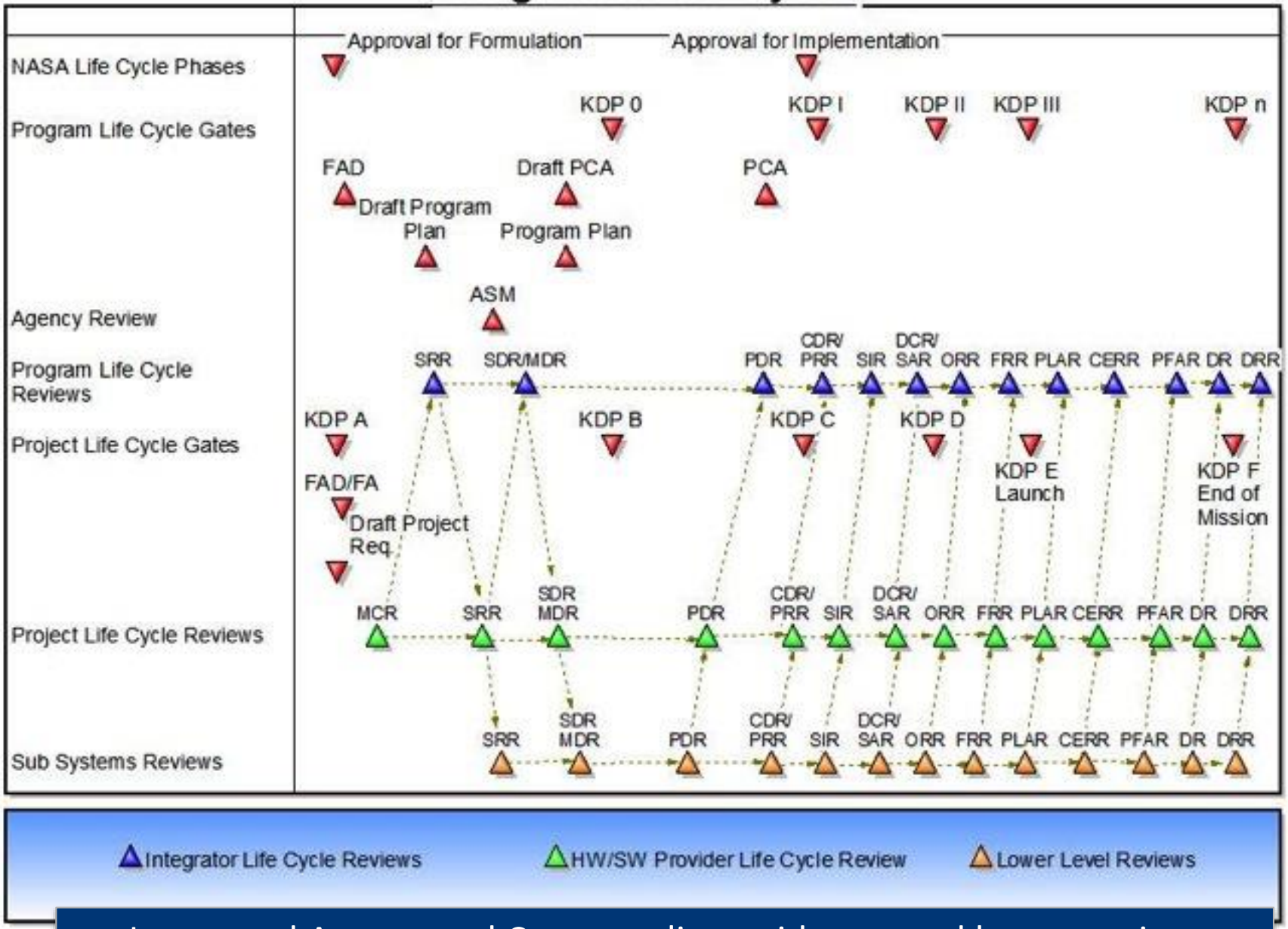
Do What We Do, But Do it Better!

Center of Excellence for Systems Engineering & Integration

Portfolio Mission Types



Integrated Life Cycle



Integrated Agency and Center policy, guidance, and best practices

Program SRR (P/SRR)

Entrance Criteria:

B/L- Formulation Authorization Document (FAD) has been approved. (Reference Data)
D- Program Plan
P- Mission Directorate requirements and constraints
D- Traceability of program-level requirements on projects to the Agency strategic goals and Mission Directorate requirements and constraints
D- Documentation of driving ground rules and assumptions on the program
D- Interagency and international agreements
D- Documented Cost and Schedule Baselines
D- Documentation of Basis of Estimate (cost and schedule)
D- Shared Infrastructure,* Staffing, and Scarce Material Requirements and Plans
Plans for work to be accomplished during next Life Cycle Phase
D- Technical, Schedule, and Cost Control Plan
D- Safety and Mission Assurance (S&MA) Plan (STD/SA-SSP, STD/RM-RMP)
D- Risk Management Plan (STD/MA-RMP, STD/RM-PRAP)
D- Acquisition Plan
D- Technology Development Plan
D- Systems Engineering Management Plan (SEMP) (STD/SE-SEMP)
D- Information Technology (IT) Plan
P - Review plan
D- Configuration Management (CM) Plan (STD/CM-CMP, STD/SW-SCMP)
D- Lessons Learned Plan
D - Integration plan (***STD/SE-IP***)
Program requirements have been defined that support mission directorate requirements on the program.
Major program risks and corresponding mitigations strategies have been identified.
The high-level program requirements have been documented to include: a. performance, b. safety, and c. programmatic requirements, consistent with the selected Conceptual design from the project MCR.
An approach for verifying compliance with program requirements has been defined.
Procedures for controlling changes to program requirements have been defined and approved.
Traceability of program requirements to individual projects is documented in accordance with Agency needs, goals, and objectives, as described in the NASA Strategic Plan.
Top program/project risks with significant technical, safety, cost and schedule impacts have been identified.

Success Criteria:

1. With respect to mission and science requirements, defined high-level program requirements are determined to be complete and are approved.

2. Defined interfaces with other programs are approved.

3. The program requirements are determined to provide a cost-effective program.

4. The program requirements are adequately levied on either the single-program project or the multiple projects of the program.

5. The plans for controlling program requirement changes have been approved.

6. The approach for verifying compliance with program requirements has been approved.

7. The mitigation strategies for handling identified major risks have been approved.

Agency requirements in black and Agency guidance in red; MSFC requirements in green and MSFC guidance in blue

Strategy for MBSE

- Enhance Systems Engineering capability with the use of models
- To be able to produce, receive, collaborate, and maintain access to complex data objects
  - …Across phases within projects
  - …Across organizational boundaries within NASA
  - …With primes, support contractors, academic/government/international partners

Driving to Meaningful MBSE Environment

- Designing with models as the design authority
- Integration of designs from multiple sources, created in different tools
- Linking requirements to design models to verification activities
- Implementing a common model library for Modeling and Simulation (non-CAD) models
- Creating conceptual product definitions interactively in an engineering collaboration environment

Initiatives

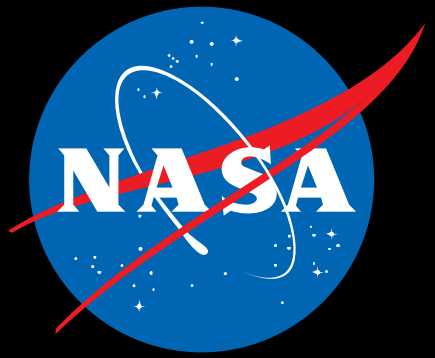
- More common initiatives
  - Traditional Requirements Definition, Logical Decomposition, Requirements Management
  - Development of Flight Software
- Relatively new initiatives
  - Conceptual Trade Studies
  - Model of Agency Systems Engineering Policy
  - Minimizing design requirements and associate verification, using model to help determine requirements to elevate as true design drivers
  - Digital representation of payload interface

Vision

- Digital representation of a System throughout the lifecycle
- Challenges
  - Infrastructure/architecture - Model Based Enterprise
  - Systems Engineering & Integration vs Modeling
  - Project Life Cycle and Life Cycle Reviews
  - Educating the work force
  - Influencing change

Conclusion

- Systems are more and more complex
- Design, Develop, Test and Evaluate is changing
- Systems Engineering & Integration will adapt
- Model Based Systems Engineering will be a key aspect of that evolution
- We’ve made the jump!



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